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**ABSTRACT:**

A vehicle friction clutch cover assembly (2) having a clutch cover (4), a pressure plate (22) and a diaphragm spring (16). The diaphragm spring (16) pivots on a fulcrum means (35) associated with at least one of the cover (4) and the pressure plate (22). The fulcrum means (35) includes a resiliently deformable elastomeric member (38) which is axially deformable when subject to the load of the spring (16). The fulcrum means may include a fulcrum ring (37) which is mounted on the elastomeric material member.

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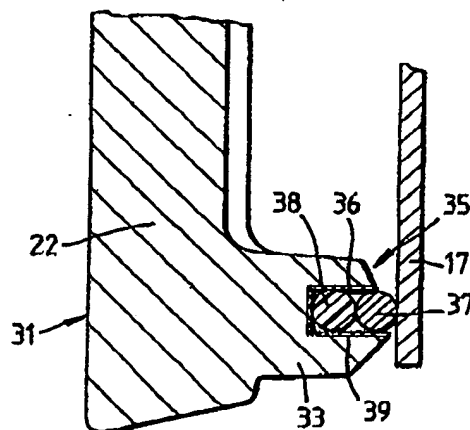
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54 Friction clutch cover assemblies.

57 A vehicle friction clutch cover assembly (2) having a clutch cover (4), a pressure plate (22) and a diaphragm spring (16). The diaphragm spring (16) pivots on a fulcrum means (36) associated with at least one of the cover (4) and the pressure plate (22). The fulcrum means (35) includes a resiliently deformable elastomeric member (38) which is axially deformable when subject to the load of the spring (16). The fulcrum means may include a fulcrum ring (37) which is mounted on the elastomeric material member.

*Fig. 4.*



## Description

## FRICTION CLUTCH COVER ASSEMBLIES

This invention relates to friction clutch cover assemblies, for example clutch cover assemblies for motor vehicles.

In a typical motor vehicle friction clutch, a driven plate, rotationally fast with the input shaft of a gearbox, is sandwiched between a flywheel on the engine crankshaft and a pressure plate. The pressure plate is usually mounted in a clutch cover assembly, and the cover is in turn mounted on the flywheel. The pressure plate is rotationally fast with the cover and the flywheel and is biased away from the cover by spring(s) to trap the driven plate between itself and the flywheel. Drive straps holding the pressure plate rotationally fast with the cover allow the pressure plate to move axially so as to enable the driven plate to be released or clamped between the flywheel and pressure plate as required.

During the clamping of a driven plate between the flywheel and pressure plate, i.e. when the vehicle clutch is engaged, it is desirable for there to be some axial resilience in the friction clutch during the engagement of the friction surfaces of the driven plate with like surfaces on the pressure plate and flywheel.

In prior art clutches the axial resilience is achieved by having cushioning elements within the driven plate, or alternatively by having cushioning elements within the pressure plate as is shown in British Patent 1050553, or US 4291792. In British Patent 1453287 there is disclosed an annular insert in the pressure plate for contacting the diaphragm spring and which has been made resilient with a series of undulations. Alternatively a resilient, wavy fulcrum ring has been located between the diaphragm spring and the clutch cover, for example as disclosed in British Patent 1583403.

The present invention seeks to provide an improved fulcrum means having some axial resilience in a clutch cover assembly which in use gives less vibration and noise and hardness during clutch re-engagements than in some known cover assemblies.

According to the invention there is provided a friction clutch cover assembly comprising a pressure plate, a coaxial cover, a coaxial diaphragm spring located between the cover and the pressure plate for loading the pressure plate and a coaxial annular fulcrum means for the diaphragm spring, said fulcrum means acting between the diaphragm spring and at least one of the cover and the pressure plate, and said fulcrum means including an axially resiliently deformable elastomeric material for deformation by action of the diaphragm spring.

The elastomeric material may be a heat resistant elastomeric material. It may be in the form of an annular disposition located in the base of an annular groove, and a fulcrum ring may sit in the groove on top of the elastomeric material.

Preferably the elastomeric material is located in an annular groove located in an annular rib on the pressure plate.

Conveniently the axial movement of the fulcrum ring on the elastomeric material is arrested before the elastomeric material is subject to the full clamp load of the diaphragm spring. This modification seeks to prevent the elastomeric material from taking on a 'set' due to being subject to high loads when the clutch is fully engaged.

Preferably the annular groove is a stepped groove having a narrow width base portion and a wider mouth portion with a shoulder therebetween, the elastomeric material is located in and stands proud of the base portion with the fulcrum ring locating in the mouth portion so that the fulcrum ring abuts the shoulder after a predetermined axial movement. The mouth portion of the groove and the fulcrum ring may be inter-related so that the fulcrum ring stands proud of the groove when in abutment with the shoulder.

In a further embodiment of the invention, the annular rib on the pressure plate comprises alternate lands and spaces, and the annular groove is an interrupted groove formed in the lands, the elastomeric material comprising an annular disposition of resilient elements each located in a said space and projecting axially beyond the adjacent lands.

Conveniently, the fulcrum ring bottoms on the base of the groove before the elastomeric material is subject to the full clamping load.

The invention will be described by way of example and with reference to the accompanying drawings in which:-

Figure 1 is a plan view of a clutch cover assembly according to this invention,

Figure 2 is a section on the line II-II of Figure 1 and also showing the clutch cover assembly fitted in a vehicle friction clutch,

Figure 3 is an enlarged section through a clutch cover assembly according to this invention,

Figure 4 is a detailed enlargement showing the resilient fulcrum means in the pressure plate,

Figures 5, 6, 7 and 8, show alternative designs for the fulcrum means,

Figure 9 is a detailed enlargement of an alternative resilient fulcrum means according to a second embodiment of the invention,

Figure 10 is a detailed enlargement of yet another alternative resilient fulcrum means,

Figure 11 shows another pressure plate for use in another embodiment of clutch cover assembly formed according to this invention,

Figure 12 is a section on the line X-X of Figure 11 additionally showing elastomeric material supporting a fulcrum ring,

Figure 13 is a fragmentary section through a push-type cover assembly according to yet another embodiment of this invention,

Figure 14 is a fragmentary section through a push-type cover assembly of another embodiment of this invention, and

Figure 15, Figure 16 and Figure 17 are fragmentary sections of respective pull-type clutch cover assemblies formed by further embodiments of the invention.

With reference to Figures 1 and 2 there is illustrated a push-type friction clutch cover assembly 2, comprising an annular cover 4, a pressure plate 22 located coaxially within the cover 4, and a coaxial diaphragm spring 16 located between the cover and the pressure plate to bias the pressure plate 22 away from the cover 4.

The cover 4 comprises a cylindrical sidewall 5 having a radially outwardly projecting flange 7 at one axial end thereof and a radially inwardly projecting flange 8 at the other end. The outwardly projecting flange 7 has a plurality of holes 6 therein whereby the cover is attached by bolts B to flywheel F on the crankshaft of a vehicle engine. The inwardly projecting flange 8 has a plurality of tabs 26 on its radially inner periphery whereby the diaphragm spring 16 is attached to the cover.

The spring 16 is a frustoconical plate spring coned away from the pressure plate 22 and having a radially outer continuous annular portion 17 with a plurality of spaced radially inwardly extending fingers 18 projecting from the radially inner periphery of the annular portion 17. The spring 16 is attached to the cover 4 by the tabs 26 on the cover, extending through respective apertures 19 at the base of the fingers 18 and being bent around the continuous portion 17 of the spring to clinch the spring to the cover. A pair of coaxial fulcrum rings 24 and 28 are located one on each side of the diaphragm spring and are located against the radially outer surface of the tabs 26 prior to the tabs being bent around the spring 16. The outer margin 17 of the spring 16 acts against a fulcrum means 35 (Figure 4) on the pressure plate 22. When the cover assembly is mounted on the flywheel F the pressure plate 22 is biased by the spring 16 to clamp a driven plate D between itself and the flywheel F. The hub H of the driven plate D is fitted onto a gearbox input shaft I. To release the driven plate D, a release load L is applied to the radially inner ends of the spring fingers 18, via a clutch release bearing G, to move the inner ends of the fingers towards the flywheel F, causing the outer annular portion 17 of the spring to pivot about the fulcrum rings 24, 28 and move away from the flywheel F. When the clutch is re-engaged the reverse operation takes place.

The pressure plate 22 is made rotationally fast with the cover 4 by three sets of drive straps 14 which extend between the cover and lugs 23 on the outer periphery of the plate 22. The drive straps 14 allow for axial movement of the pressure plate 22 relative to the cover 4 whilst holding the two rotationally fast.

Cover assembly 2 is shown in more detail in Figures 3 and 4, the pressure plate 22 is an annular cast-iron body 30 having on one axial side a friction surface 31 for engagement with the driven plate, and on its other axial side a raised annular rib 33 extending axially away from the friction surface 31. The fulcrum means 35 is located in an annular groove 36 located in the top portion of the rib 33. The fulcrum means 35 comprises a fulcrum ring 37,

which may be axially substantially rigid, and which is supported on a bed of elastomeric material in the form of a rubber ring 38. The resilient elastomeric material 38 provides for the axial cushioning in the clutch during the re-engagement of the clutch. The annular groove 36 is of sufficient depth to accommodate the rubber ring 38 and partially accommodate the fulcrum ring 37 so that the ring 37 stands proud of the groove and the rubber is deformed under an axial load applied through the fulcrum ring 37.

The rubber ring 38 can be made out of a heat resistant elastomer. If desired the groove can be lined by a heat insulating layer 39.

The fulcrum ring 37 can be a split ring or a continuous ring, and whilst in the above example the groove 36 and the rubber ring 38 are continuous, it will be shown in a following example that they could both be interrupted. Figures 5 to 8 show alternative cross-sections for the rubber ring and in Figure 8 shows the base of the groove 36 having a rounded bottom 41. The type of cross-section of rubber ring can be designed to suit the clutch characteristics that are required, and also the flow characteristic of the rubber can be made to suit.

With reference now to Figure 9, there is illustrated an alternative resilient fulcrum means in which the full clamping load of the spring 16 is prevented from acting on the rubber ring 38. The outer margin 17 of the frustoconical spring 16 rests on a fulcrum ring 37 which is shown in full line in the clutch released mode and in dotted line 37A in the clutch fully engaged mode. The fulcrum ring 37 is located in an annular groove 36', which like the groove 36 in Figures 3 and 4, is located in the top portion of the annular rib 33 on the pressure plate 22. The fulcrum ring 37 is mounted on a bed of elastomeric material 38'.

The groove 36' is a stepped groove having a narrower base portion 51 and a wider mouth portion 52 with a shoulder 53 therebetween. Preferably the narrow portion 51 is symmetrically located with respect to the wider mouth portion 51, to provide a pair of square shoulders 53. The elastomeric material 38' has a circular cross-section and in a clutch released mode projects above the shoulders 53 to stand proud of the base portion 51, and the fulcrum ring 37 locates in the wider mouth portion 52 of the groove. The fulcrum ring 37 is of sufficient cross-section so that when subject to an axial load due to the clamping load of the diaphragm spring, then after a predetermined amount of deformation of the elastomeric material 38' the fulcrum ring 37 will abut the shoulders 53, before the full clamping load of the spring is exerted on the elastomeric material. It is preferable for the fulcrum ring 37 and the mouth portion 52 of the groove 36 to have interrelated dimensions so that the ring 37 stands proud of the groove even when it is bottomed on the shoulders 53, as shown in dotted lines 37A. This is because, if the fulcrum ring 37 sinks completely into the annular groove 36, the fulcrum point P for the diaphragm spring would alter from the fulcrum ring to either position Y or position Z on the annular rib, thus altering the lever ratio for the spring fingers 16. This

may relay a disquieting feed-back to the vehicle driver. The elastomeric material may be in the form of extruded 'O' ring material, or as a length or a plurality of interrupted lengths in annular array, or could be cured in-situ in the groove. A silicone rubber is preferred.

In Figure 10 there is shown an alternate cross-section of stepped groove 336 in which the shoulders 353 are chamfered or otherwise shaped to provide a preferred load bearing surface tending to make surface rather than edge contact with the fulcrum ring. The elastomeric material 338 can be shaped to give the desired load/deflection characteristics.

With reference now to Figures 11 and 12 there is illustrated a plan view of a pressure plate 122 in which annular rib 133 is an interrupted rib comprising circumferentially extending lands 134 with spaces 135 inbetween. Annular groove 136 is an interrupted groove located in the top of the lands 134. Rubber supports 138 are located in the spaces 135 between the lands and extend axially beyond the bases of the grooves 136 so as to support the fulcrum ring 37 by a distance 'd' above the base of the groove 136. When a load is applied to the fulcrum ring 37 it will cause the rubber supports 138 to resiliently deform until the spring abuts the base of the groove in the lands.

The distance 'd' is chosen so that the fulcrum ring abuts the base of the groove 136 before the rubber supports 138 are subjected to the full clamping load of the diaphragm spring.

An advantage of a cover assembly in Figures 11 and 12 is that even if the rubber support fails, the fulcrum ring 137, when it bottoms against the groove 136, will still operate even though the axial cushioning may no longer be present.

With reference to Figures 13 to 17, there are illustrated a variety of friction clutch cover assemblies, and the same reference numerals will be used in each figure for those components which serve the same function in each drawing. In Figures 13 and 14 there are illustrated push-type friction clutch cover assemblies in which to release the clutch driven plate the release bearing G illustrated in Figure 1 would move towards the flywheel. Both cover assemblies comprise an annular cover 204 having a pressure plate 222 located in the cover 204, and a diaphragm spring 216 located between the cover 204 and pressure plate 222 to bias the pressure plate axially away from the cover 204. As previously described with reference to figures 1 and 2, the diaphragm spring 216 is held to the cover 204 by tab 226 bent through apertures in the diaphragm spring. Resilient means 235 acts between the outer peripheral margin 217 of the diaphragm spring and the pressure plate 222. The resilient means 235 may be a continuous ring or heat resistant elastomer, or alternatively may be an annular array of arcuate segments.

In the embodiment of Figure 13 the resilient means 235A is secured to the diaphragm spring 217, and in the embodiment of Figure 14 the resilient means 235B is secured to the raised annular rib 233 on the back of the pressure plate 222. The elastomeric ring 235A or 235B can be secured in place by any suitable method, e.g. adhesive, in situ vulcanisation,

or curing.

In Figures 15, 16 and 17, are illustrated pull-type friction clutch cover assemblies in which to release the clutch driven plate the releasing bearing would be moved away from the vehicle flywheel. The diaphragm spring 217 is pivoted to the cover by a fulcrum 230 acting on the outer peripheral margin of the spring. In the embodiment of Figure 15 the fulcrum 230 is in the form of a ring, whereas in the embodiment of Figure 16 and Figure 17 the fulcrum 230A is in the form of a raised annular boss pressed in the cover. The spring 217 acts against the raised rib 233 on the pressure plate 222 radially inwardly of the fulcrum 230.

In the embodiment shown in Figs 15 & 17, the resilient means 235A is a rubber ring secured to the diaphragm spring as described above with respect to Figure 13, and in the embodiment shown in Figure 16 the resilient means 235B is a rubber ring secured to the cover. As described above the ring may be a continuous ring or may be segmented.

## Claims

1. A friction clutch cover assembly (2) comprising a pressure plate (22), a coaxial cover (4), a coaxial diaphragm spring (16) located between the cover (4) and the pressure plate (22) (122) for loading the pressure plate, and a coaxial annular fulcrum means (35) for the diaphragm spring, said fulcrum means (35) acting between the diaphragm spring (16) and at least one of the cover (4) and the pressure plate (22), characterised in that said fulcrum means (35) includes an axially resiliently deformable elastomeric material member (38,138,235,338) which is axially deformable when subject to a load by the diaphragm spring (16).

2. A friction clutch cover assembly as claimed in Claim 1 characterised in that said fulcrum means (35) comprises a fulcrum ring (37) (230) mounted on the elastomeric material member (38,138,338,235).

3. A friction clutch cover assembly as claimed in Claim 1 or Claim 2 characterised in that the elastomeric material member (38) (338) is annularly disposed and is located in the base of an annular groove (36), and the fulcrum ring (37) is supported by the elastomeric material member.

4. A friction clutch cover assembly as claimed in any one of Claims 1 to 3 characterised in that said annular fulcrum means (35) acts between the pressure plate (22) (122) and the diaphragm spring (16).

5. A friction clutch cover assembly as claimed in Claim 4 characterised in that the fulcrum means (35) is located in a groove (36) in an annular rib (33) (133) on the pressure plate (22) (122).

6. A friction clutch cover assembly as claimed in Claim 5 characterised in that the annular rib (133) comprises alternate lands (134) and spaces

(135), and the annular groove is an interrupted groove (136) formed in the lands (134), the elastomeric material member comprising an annular disposition of resilient elements (138) each located in a respective space (135) and projecting axially beyond the adjacent lands (134).

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7. A clutch cover assembly as claimed in any one of Claims 1 to 6 characterised in that the axial deformation of the elastomeric material member (38, 138, 235, 338) is limited by stop means (53;353;134).

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8. A clutch cover assembly as claimed in Claim 2 or any one of Claims 3 to 7 when dependent upon Claim 2, characterised in that the axial movement of the fulcrum ring (37) on the deformable elastomeric material member (38, 138, 338) is arrested before the elastomeric material is subject to the full clamp load of the diaphragm spring.

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9. A clutch cover assembly as claimed in Claim 3, or in any one of Claims 4, 5, 7 or 8 when said Claim is dependent upon Claim 3, characterised in that the annular groove (36') (336) is a stepped groove having a narrow base portion (51) (351) and a wider mouth portion (52) (352) with a shoulder (53) (353) therebetween, the elastomeric material member (38) (338) is located in and stands proud of the base portion (51) (351) with the fulcrum ring located in the mouth portion (52) (352) so that the fulcrum ring (37) abuts the shoulder (53) (353) after a predetermined axial movement.

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10. A clutch cover assembly as claimed in Claim 9 characterised in that the dimensions of the fulcrum ring (37) and the mouth portion (52) (352) of the groove (36) (336) are inter-related such that the fulcrum ring stands proud of the groove when it abuts the shoulder (53) (353).

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11. A clutch cover assembly as claimed in Claim 6, characterised in that the fulcrum ring (37) bottoms on the base of the groove (136) before the elastomeric material member (138) is subject to the full clamping load of the diaphragm spring.

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12. A friction clutch cover assembly as claimed in Claim 1 and which is for a pull type clutch characterised in that the fulcrum means associated between the diaphragm spring (216) and the cover (204) includes an elastomeric material member (235) arranged in an annular form to act between the diaphragm spring (216) and the cover (204).

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13. A friction clutch cover assembly as claimed in Claim 4 when dependent upon Claim 1, characterised in that the elastomeric material member (235B) is secured on the pressure plate.

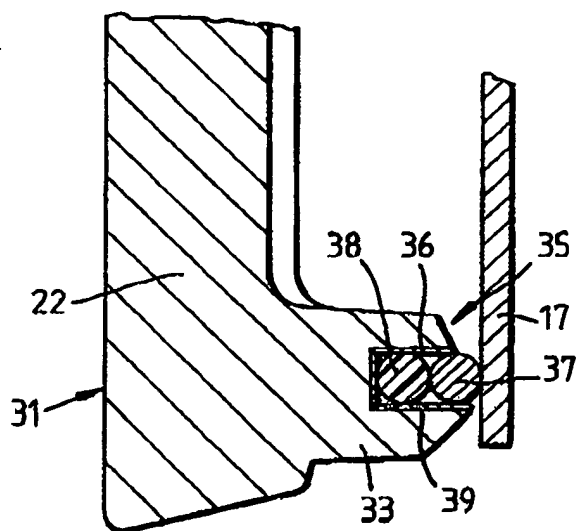
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*Fig. 4.*



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Fig.3.

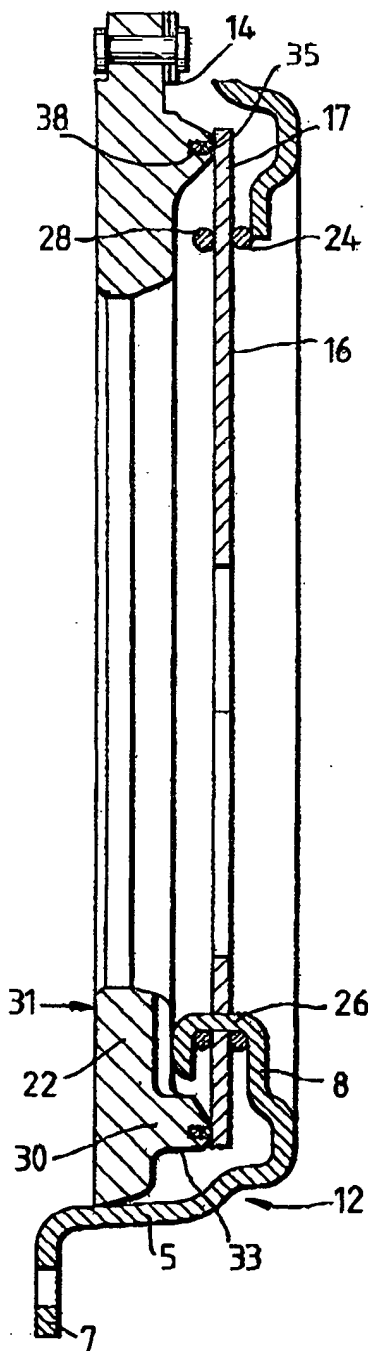


Fig.5.

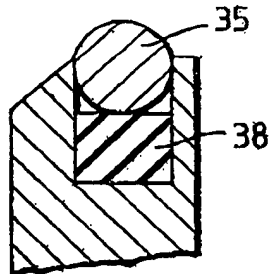


Fig.6.

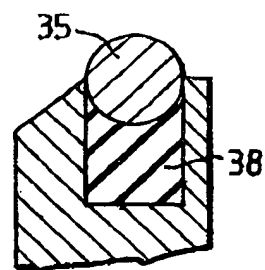


Fig.7.

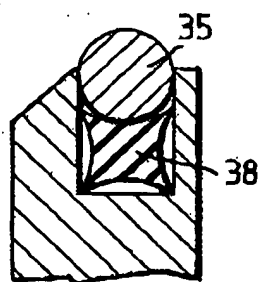


Fig.8.

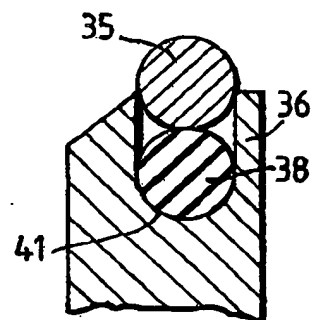




Fig. 9.

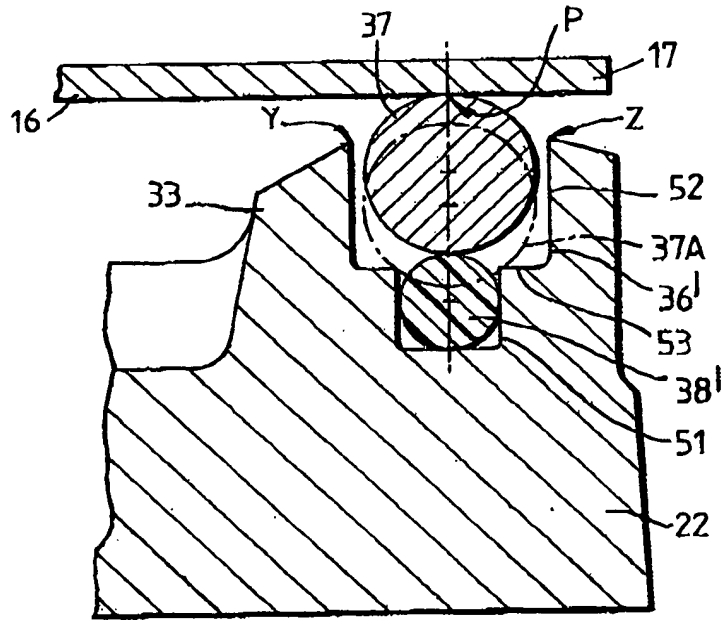
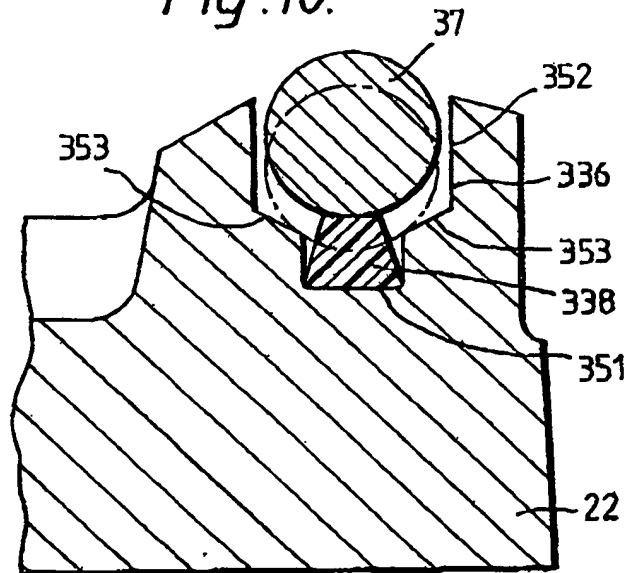


Fig. 10.



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Fig. 11.

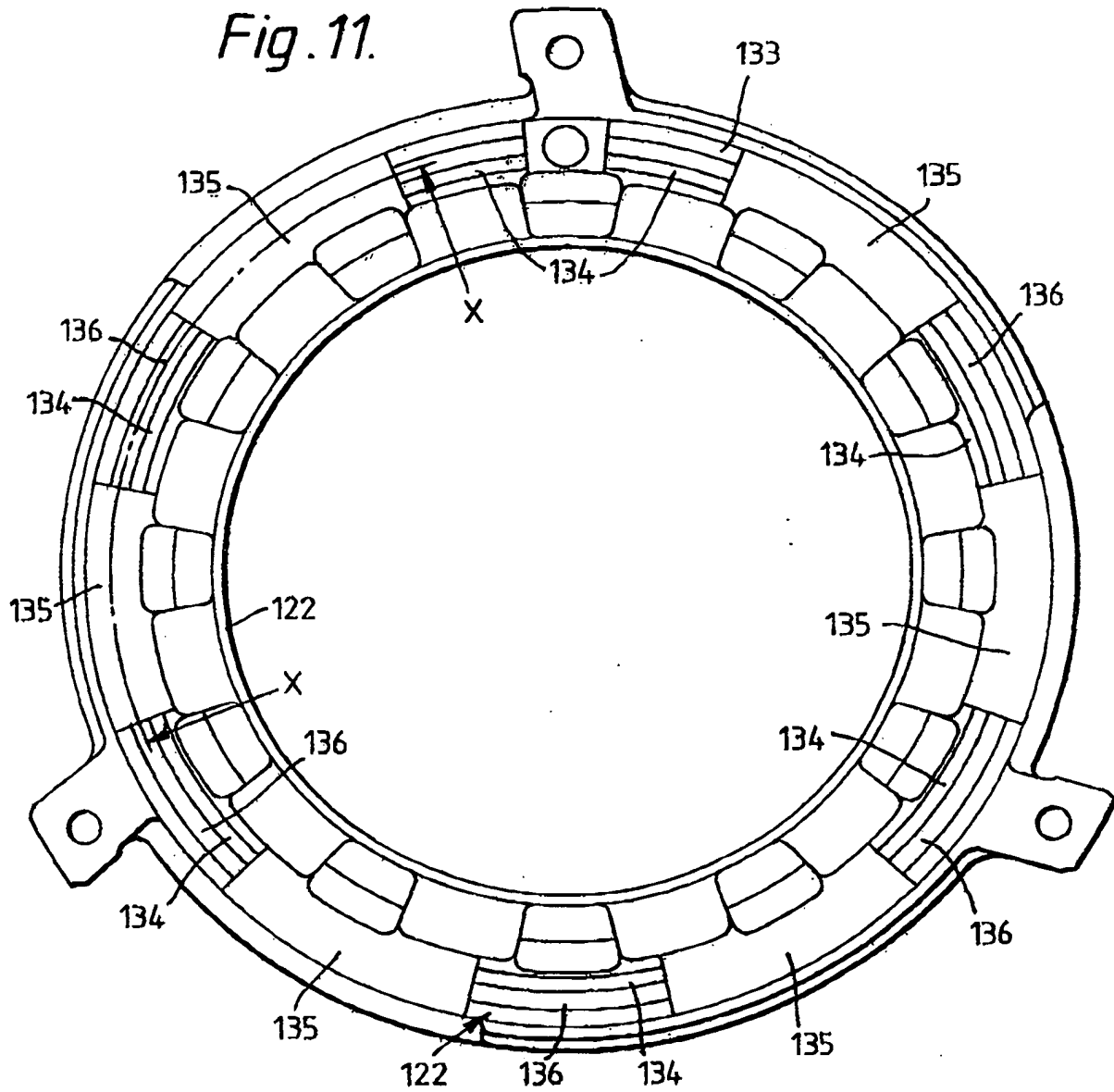
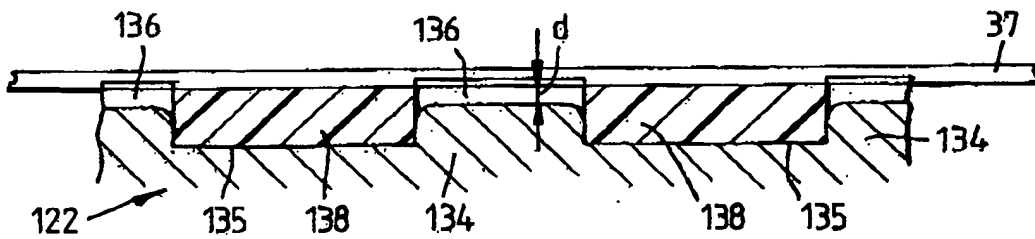


Fig. 12.



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Fig. 13.

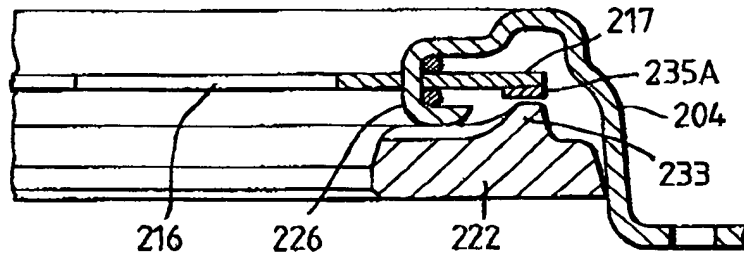


Fig. 14.

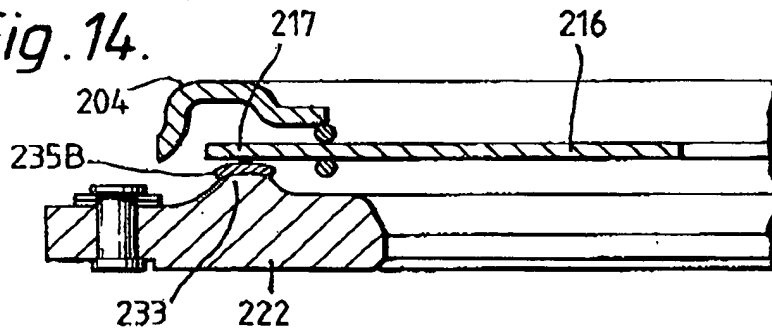


Fig. 15.

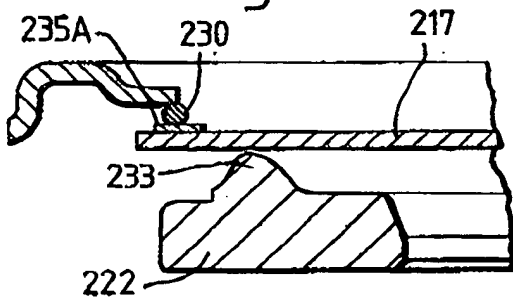


Fig. 16.

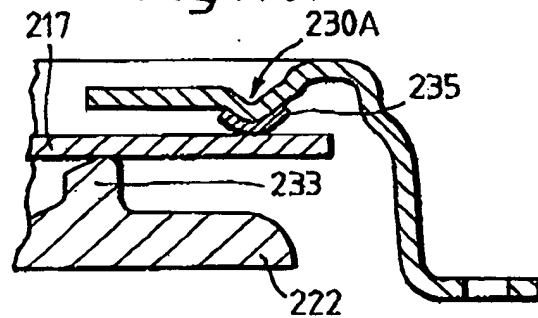


Fig. 17.

